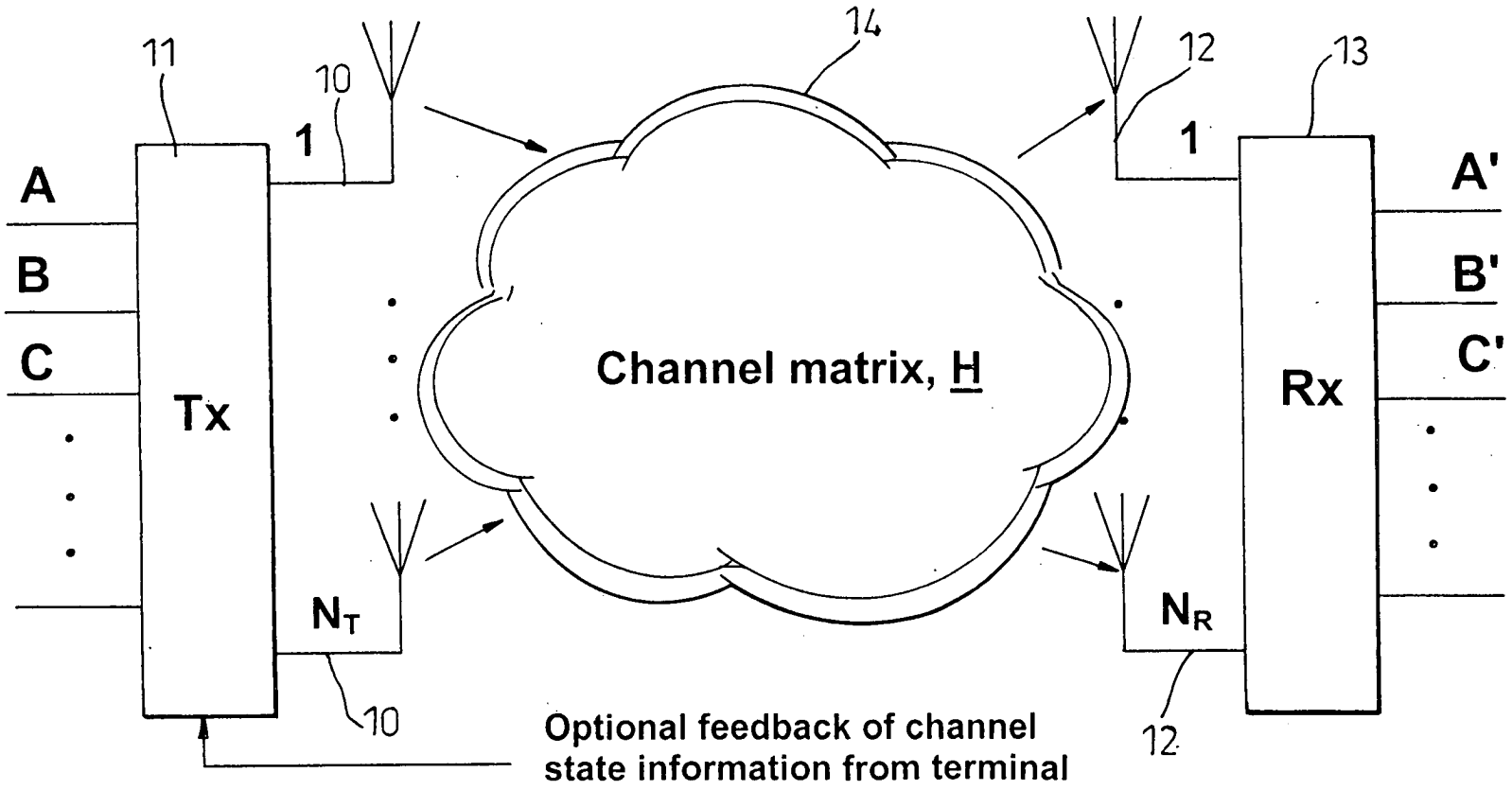


Fig. 1
(PRIOR ART)

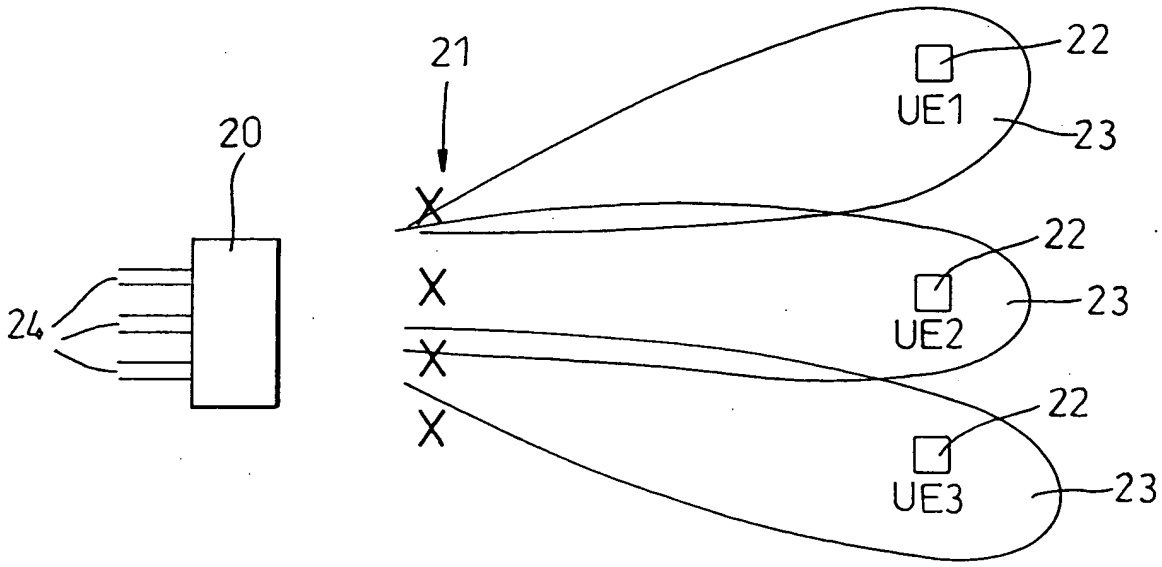


Fig. 2
(PRIOR ART)

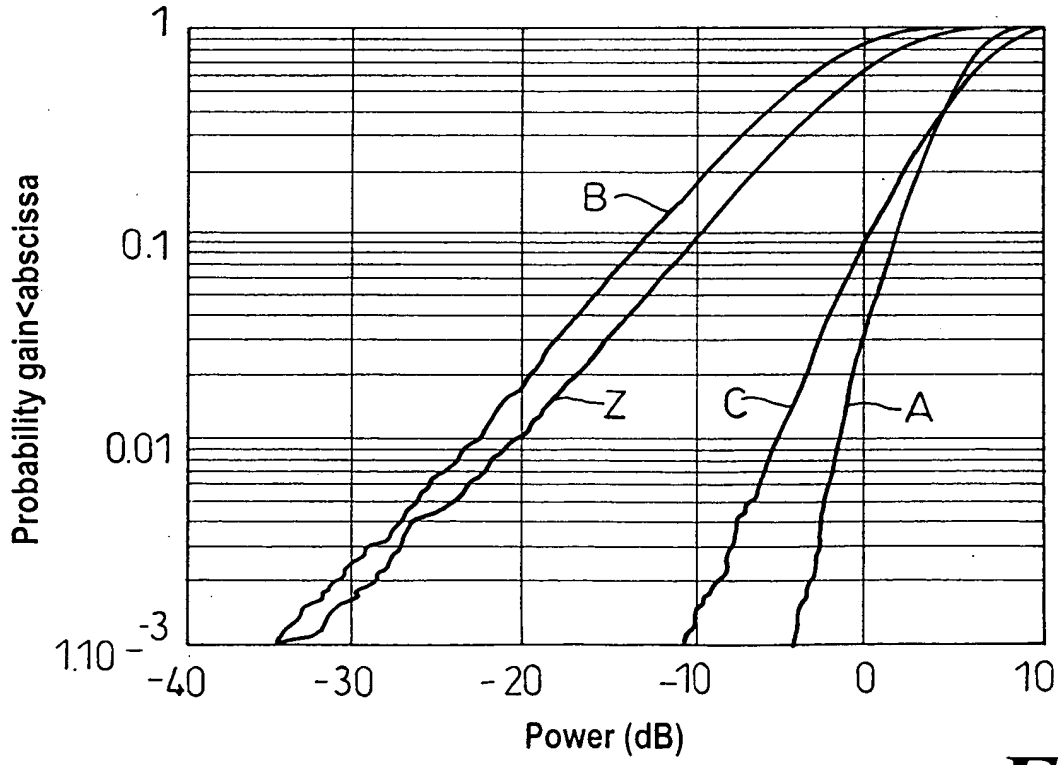
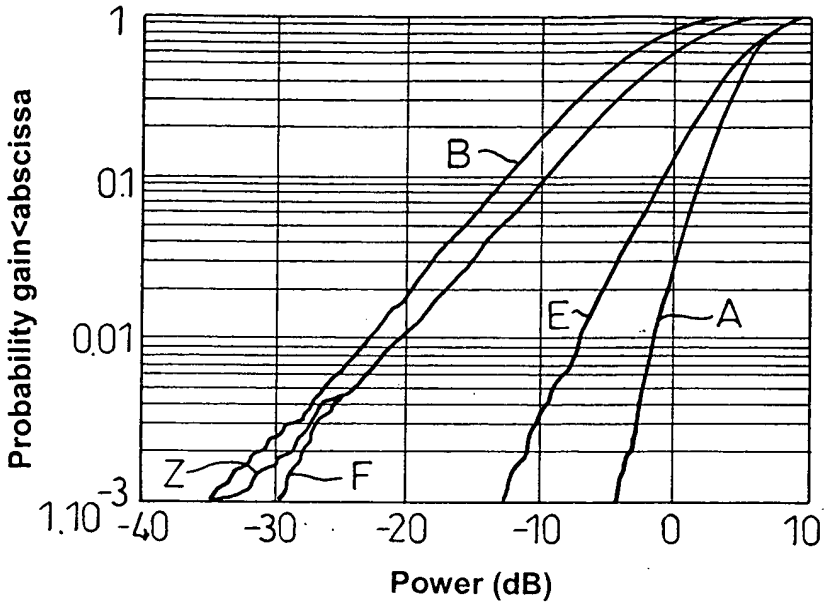


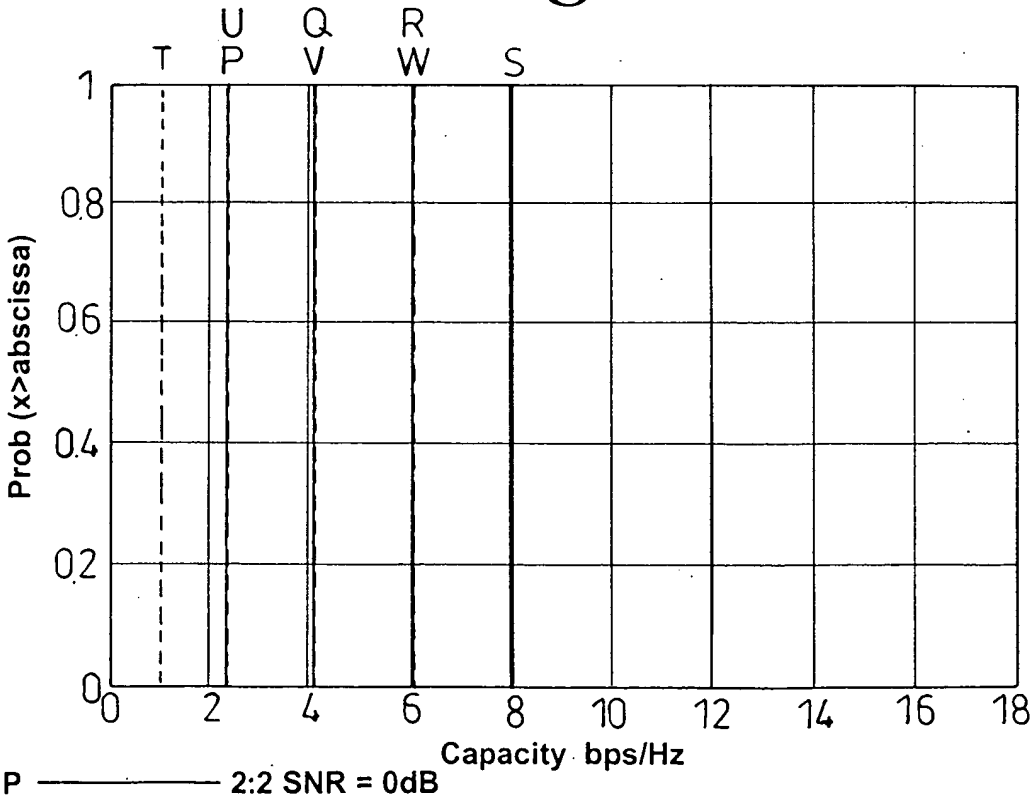
Fig. 3

A Max channel, no correlation
B Min channel, no correlation
C Max channel, complete correlation
D Min channel, complete correlation (not present)
Z Baseline 1:1



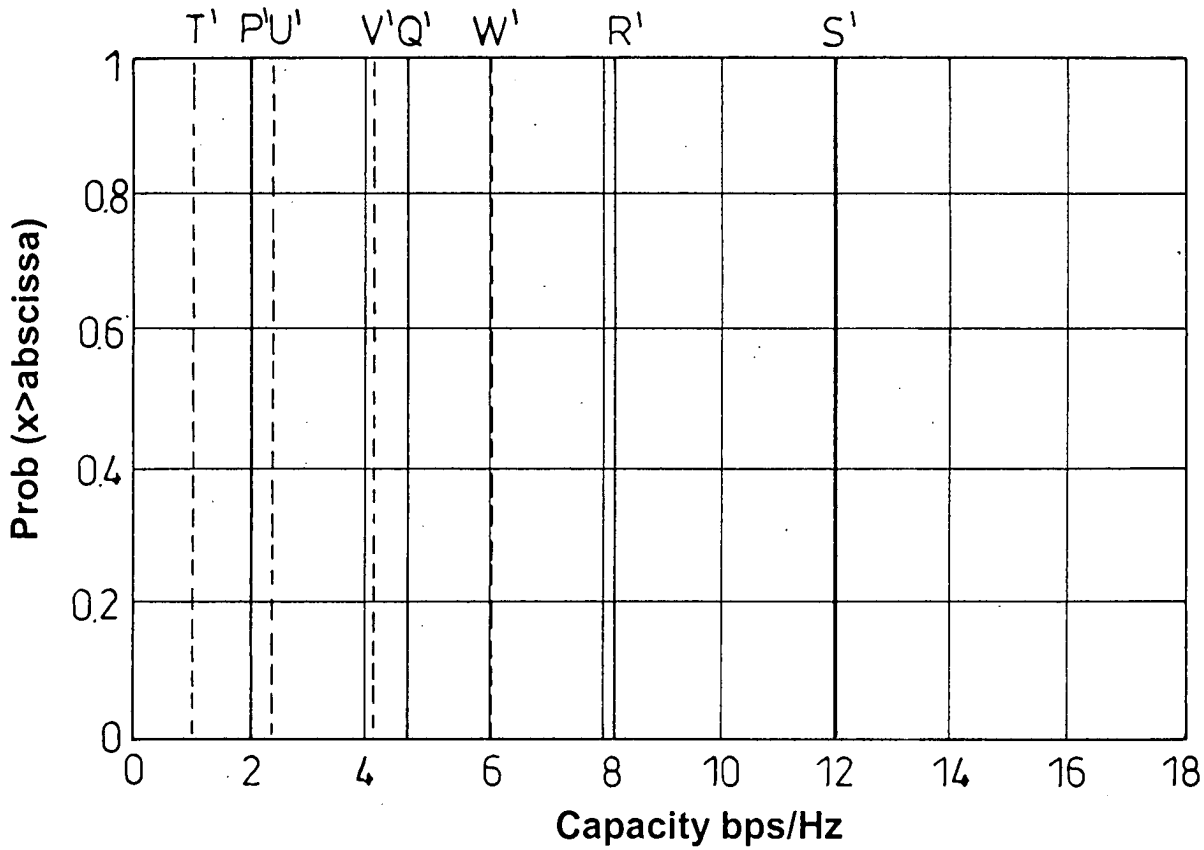
A Max channel, polarisation diversity, full polarisation conversion
B Min channel, polarisation diversity, full polarisation conversion
E Max channel, pol'n diversity, no polarisation conversion
F Min channel, pol'n diversity, no polarisation conversion
Z Baseline 1:1

Fig. 4



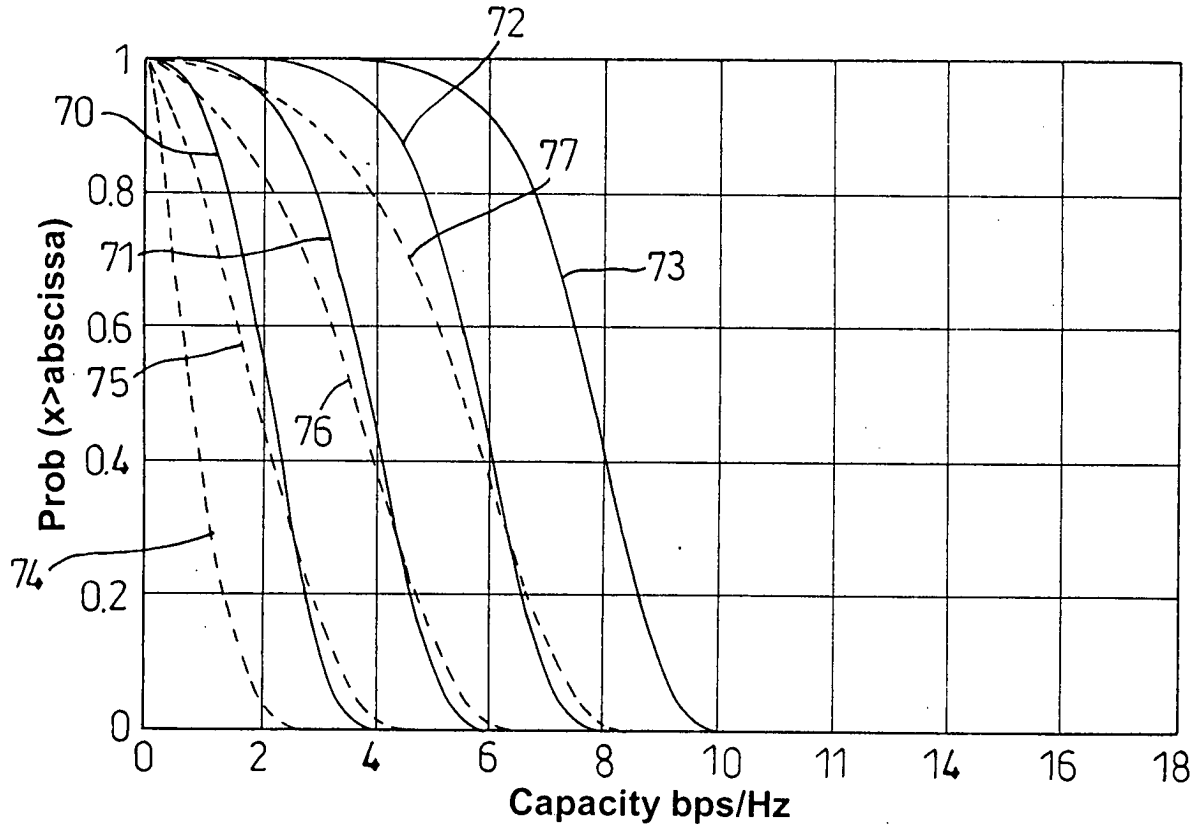
P ——— 2:2 SNR = 0dB
Q ——— 2:2 SNR = 6dB
R ——— 2:2 SNR = 12dB
S ——— 2:2 SNR = 18dB
T - - - - - - 1:1 SNR = 0dB
U - - - - - - 1:1 SNR = 6dB
V - - - - - - 1:1 SNR = 12dB
W - - - - - - 1:1 SNR = 18dB

Fig 5



P' ———— 2:2 SNR = 0dB
Q' ———— 2:2 SNR = 6dB
R' ———— 2:2 SNR = 12dB
S' ———— 2:2 SNR = 18dB
T' - - - — — 1:1 SNR = 0dB
U' — — — — 1:1 SNR = 6dB
V' — — — — 1:1 SNR = 12dB
W' — — — — 1:1 SNR = 18dB

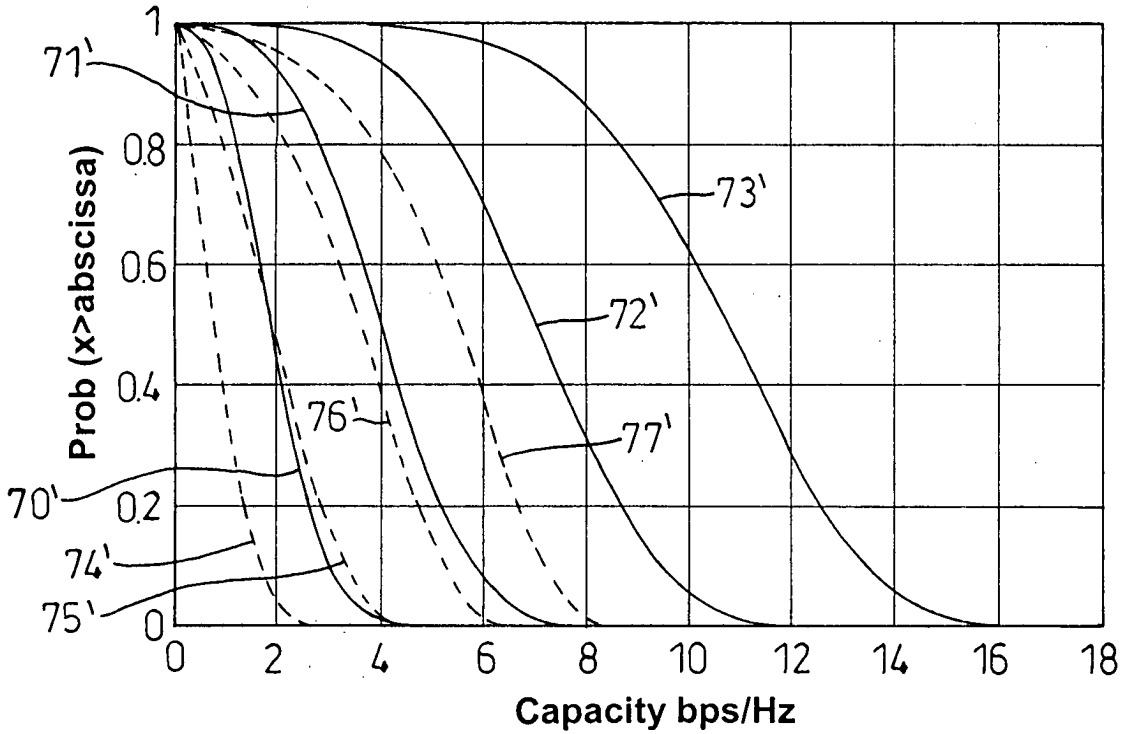
Fig. 6



70 ———— 2:2 SNR = 0dB
71 ———— 2:2 SNR = 6dB
72 ———— 2:2 SNR = 12dB
73 ———— 2:2 SNR = 18dB
74 - - - - - - - - 1:1 SNR = 0dB
75 - - - - - - - - 1:1 SNR = 6dB
76 - - - - - - - - 1:1 SNR = 12dB
77 - - - - - - - - 1:1 SNR = 18dB

Capacity for 2.2 space diversity MIMO system with the basestation antennas (transmitter) completely correlated and the mobile completely uncorrelated.

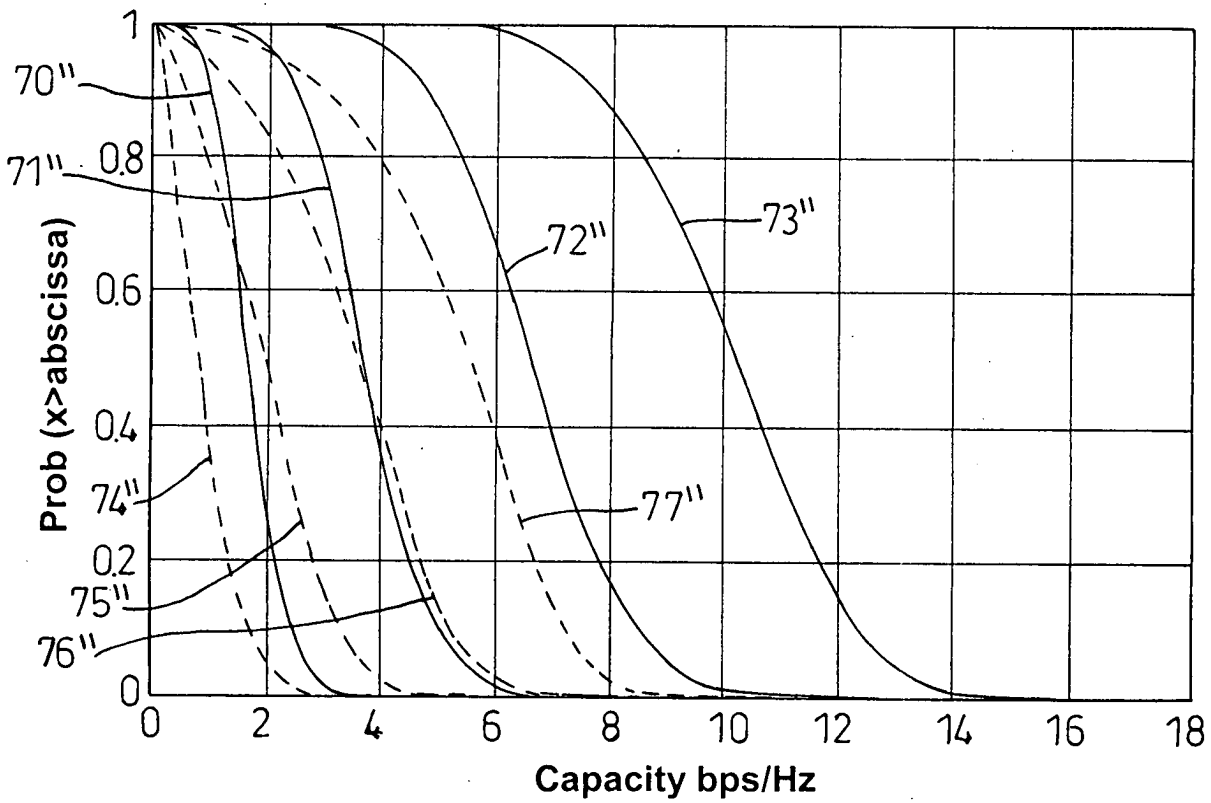
Fig. 7



70' ——————— 2:2 SNR = 0dB
71' ——————— 2:2 SNR = 6dB
72' ——————— 2:2 SNR = 12dB
73' ——————— 2:2 SNR = 18dB
74' - - - - - - - - 1:1 SNR = 0dB
75' - - - - - - - - 1:1 SNR = 6dB
76' - - - - - - - - 1:1 SNR = 12dB
77' - - - - - - - - 1:1 SNR = 18dB

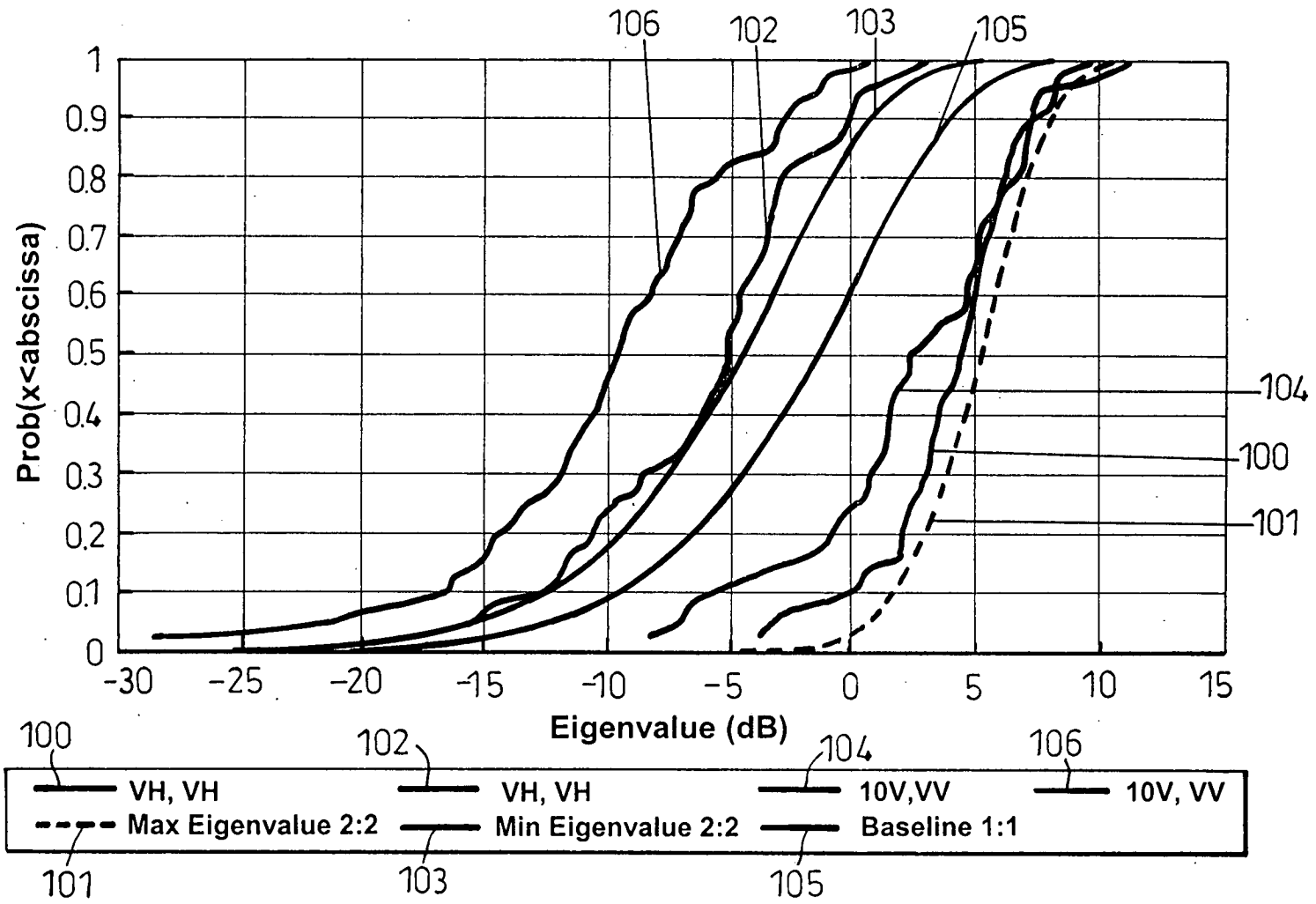
Capacity for 2:2 polarisation diversity MIMO with no polarisation conversion in the environment

Fig. 8



70" ———— 2:2 SNR = 0dB
71" ———— 2:2 SNR = 6dB
72" ———— 2:2 SNR = 12dB
73" ———— 2:2 SNR = 18dB
74" - - - - - - - - 1:1 SNR = 0dB
75" — — — — — — 1:1 SNR = 6dB
76" - - - - - - - - 1:1 SNR = 12dB
77" - - - - - - - - 1:1 SNR = 18dB

Fig. 9



Measured ditributions for the power gains for the orthogonal MIMO paths for 2:2 space and polarisation diversity configurations.

Fig 10

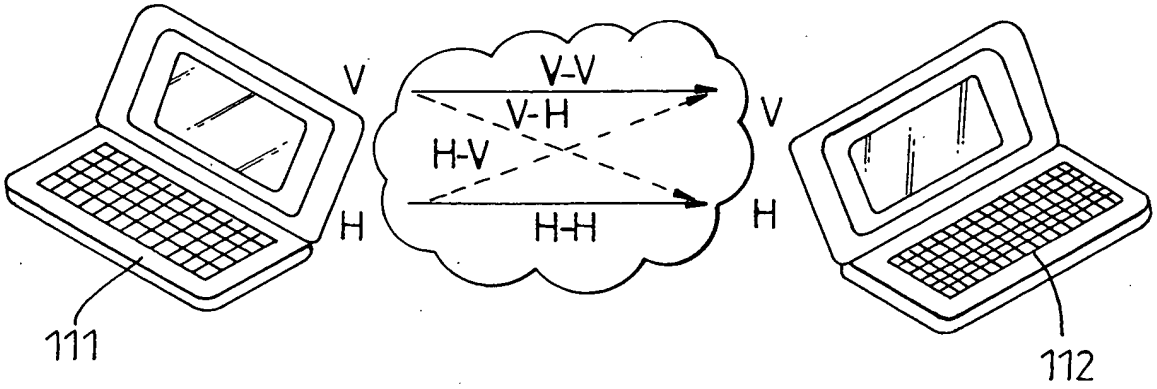

V
H
V-V
V-H
H-V
H-H
V
H
111
112

Fig. 11

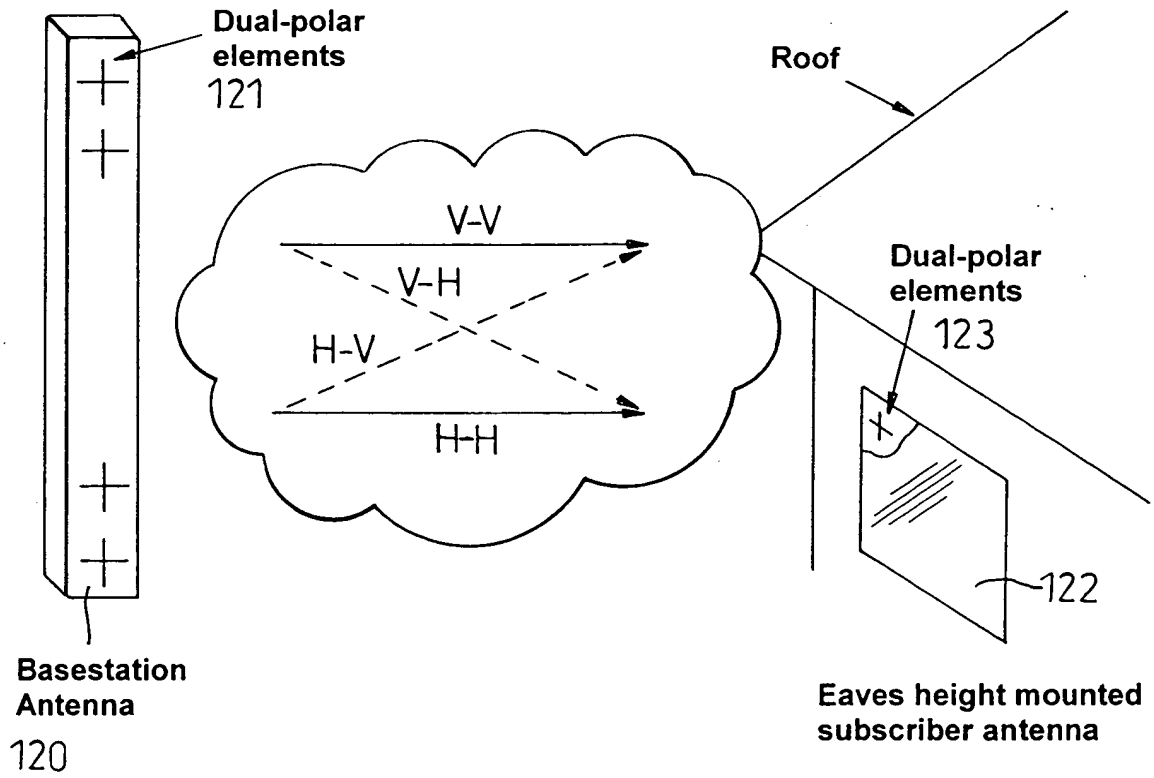

Dual-polar
elements
121
Roof
V-V
V-H
H-V
H-H
Dual-polar
elements
123
122
Basestation
Antenna
120
Eaves height mounted
subscriber antenna

Fig 12

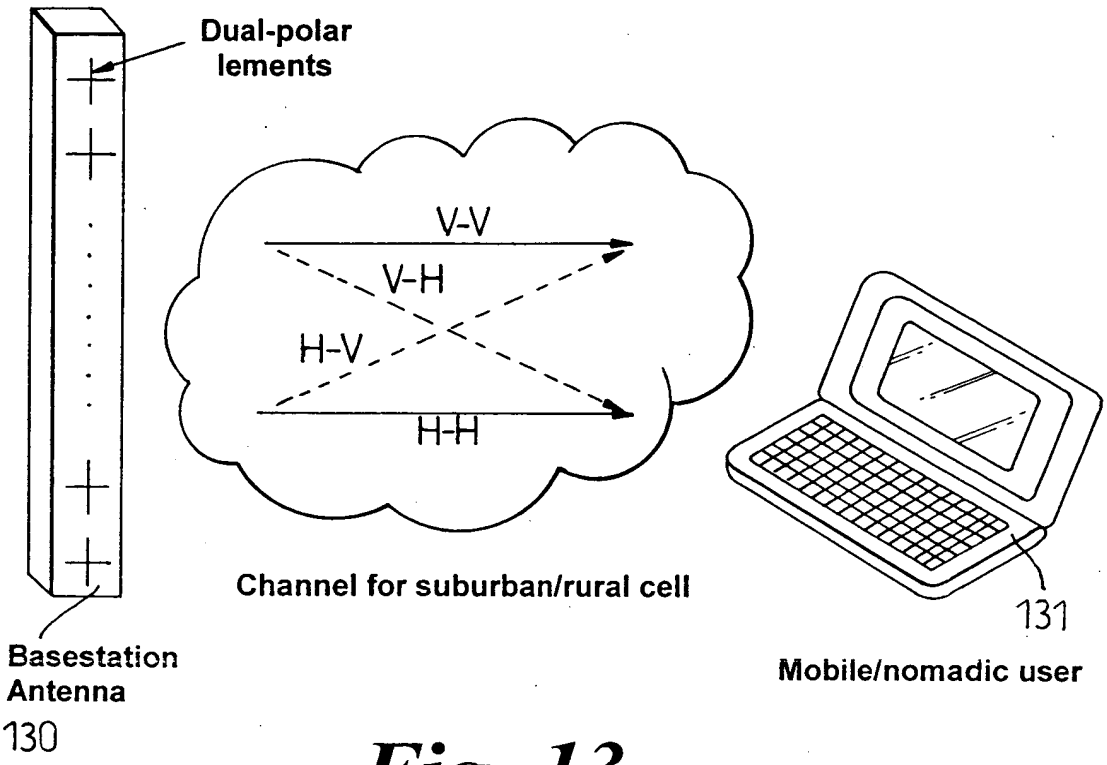

Dual-polar
lements
V-V
V-H
H-V
H-H
Channel for suburban/rural cell
131
Mobile/nomadic user
Basestation
Antenna
130

Fig. 13

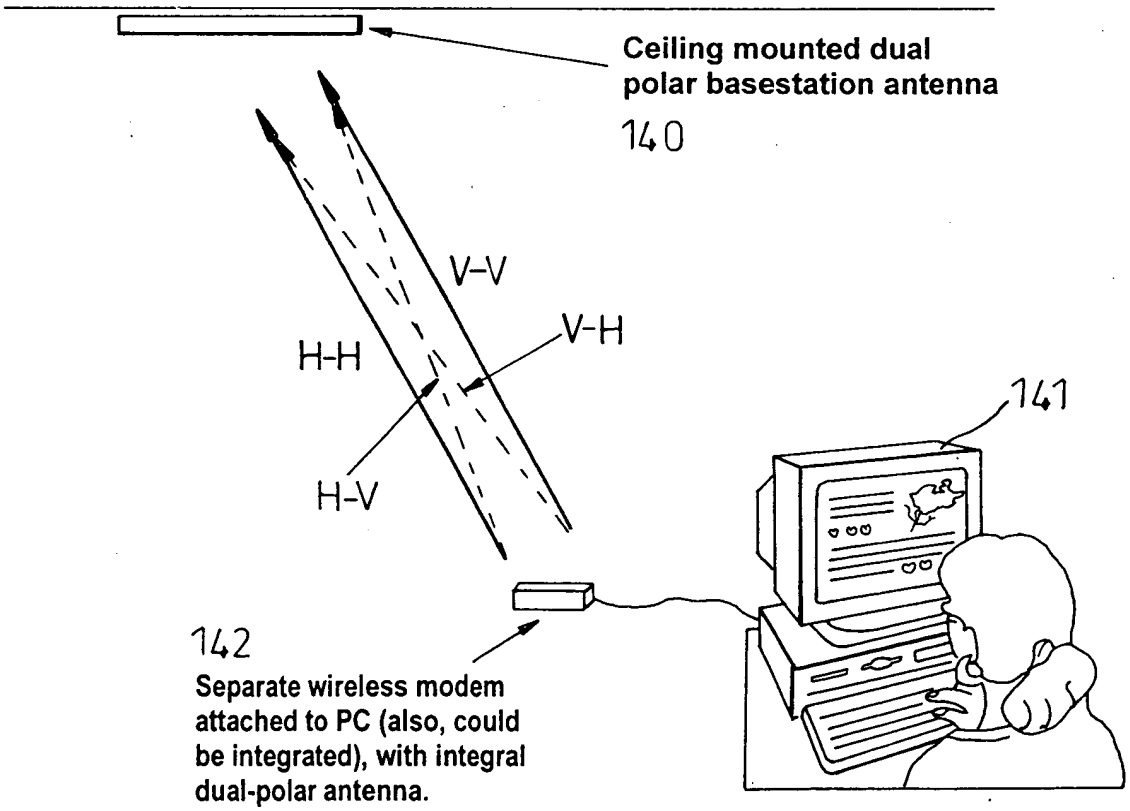

Ceiling mounted dual
polar basestation antenna
140
V-V
V-H
H-H
H-V
141
142
Separate wireless modem
attached to PC (also, could
be integrated), with integral
dual-polar antenna.

Fig 14

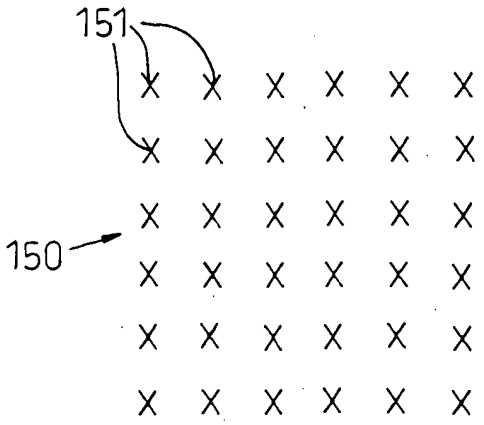


Fig. 15A

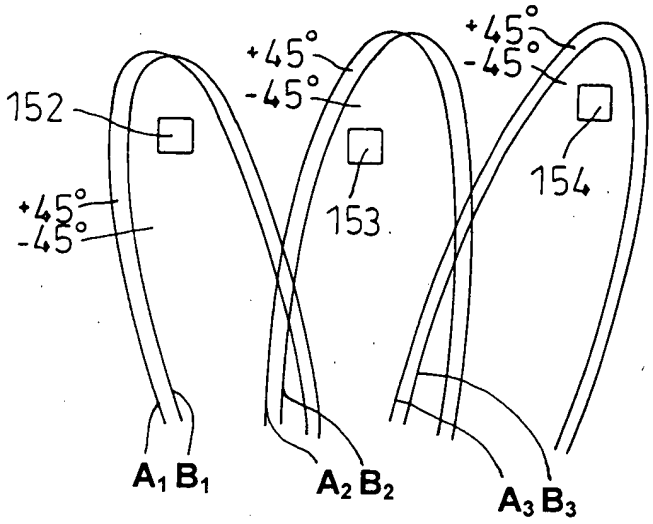


Fig. 15B

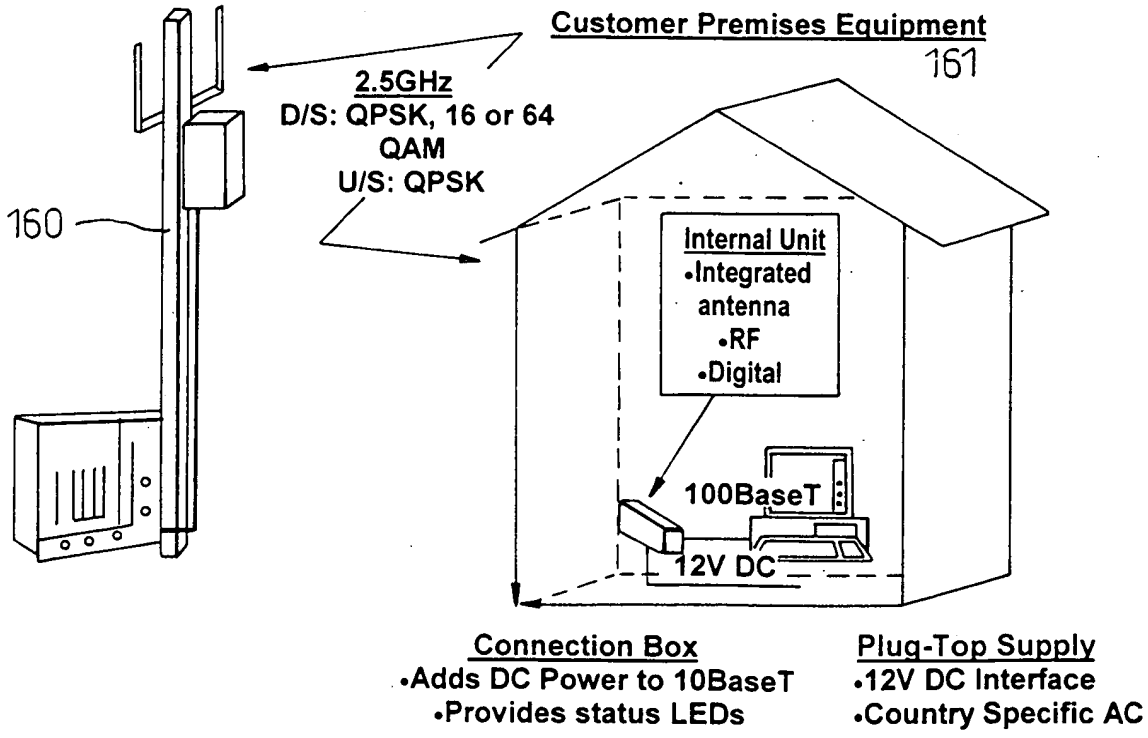


Fig 16

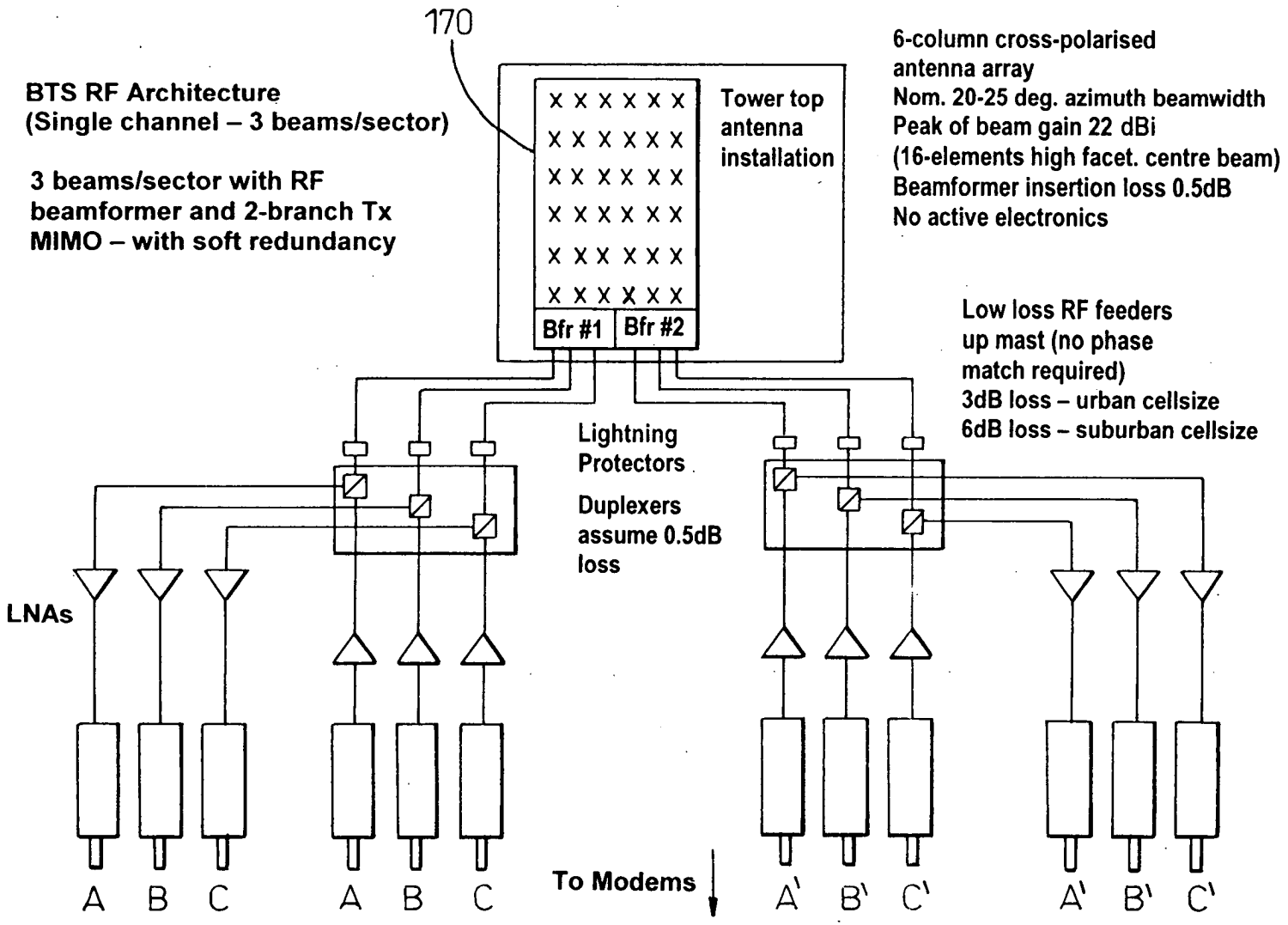

170
BTS RF Architecture
(Single channel – 3 beams/sector)
3 beams/sector with RF beamformer and 2-branch Tx MIMO – with soft redundancy
Tower top antenna installation
Bfr #1
Bfr #2
6-column cross-polarised antenna array
Nom. 20-25 deg. azimuth beamwidth
Peak of beam gain 22 dBi
(16-elements high facet. centre beam)
Beamformer insertion loss 0.5dB
No active electronics
Low loss RF feeders up mast (no phase match required)
3dB loss – urban cellsize
6dB loss – suburban cellsize
Lightning Protectors
Duplexers assume 0.5dB loss
LNAs
To Modems
A B C A B C A' B' C' A' B' C'

Fig. 17

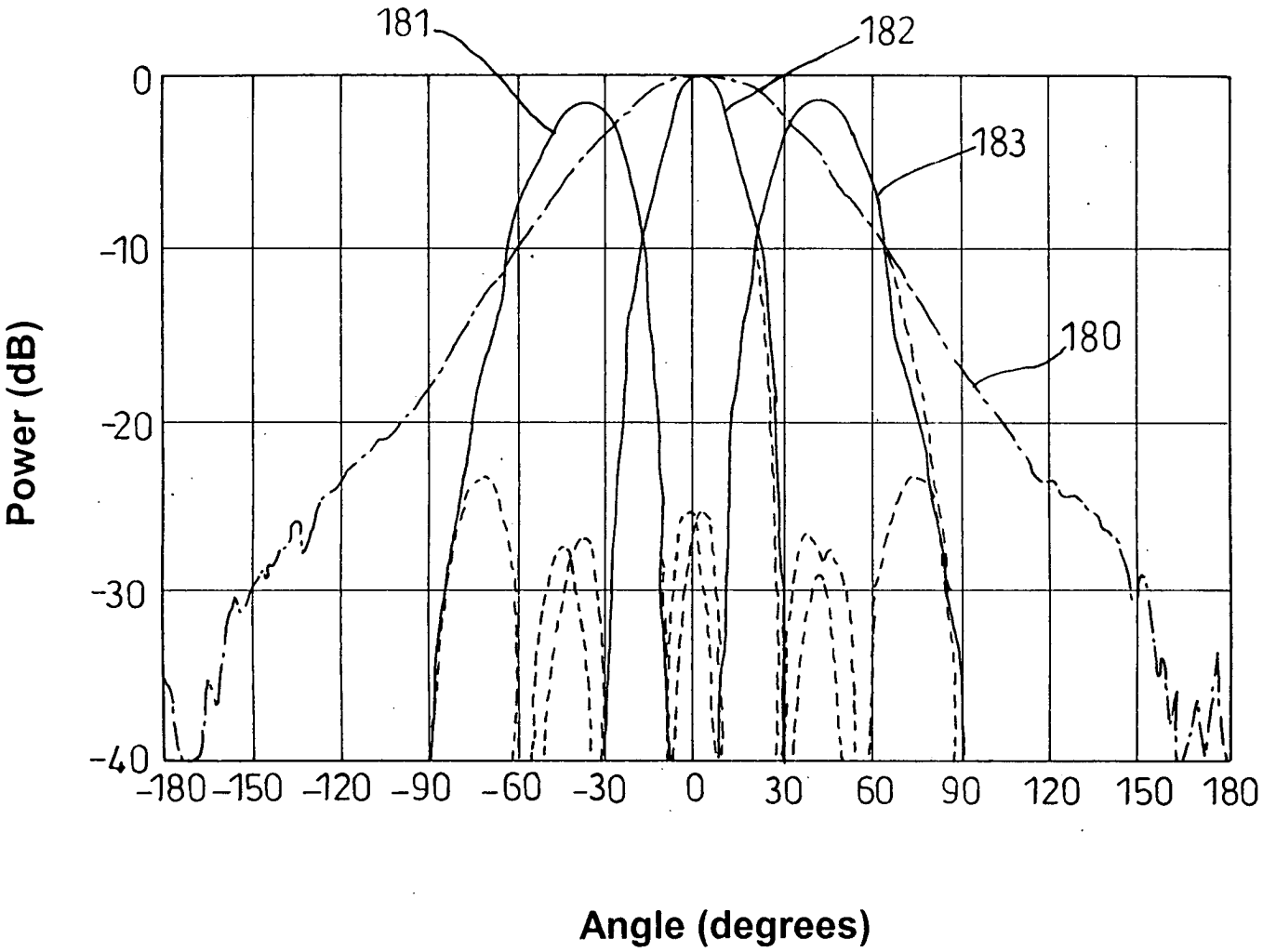
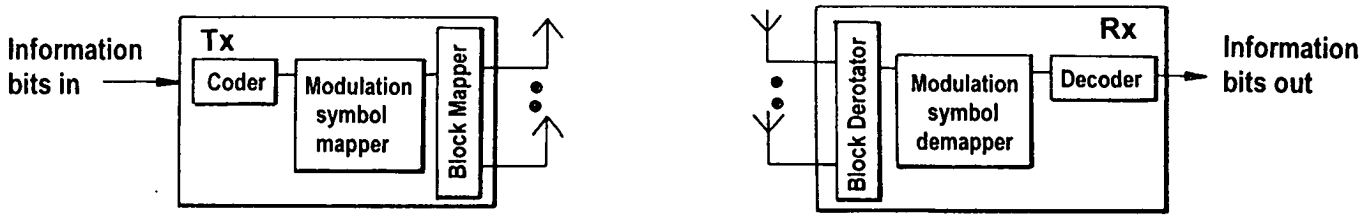

181
182
183
180
0
-10
-20
-30
-40
-180 -150 -120 -90 -60 -30 0 30 60 90 120 150 180
Power (dB)
Angle (degrees)

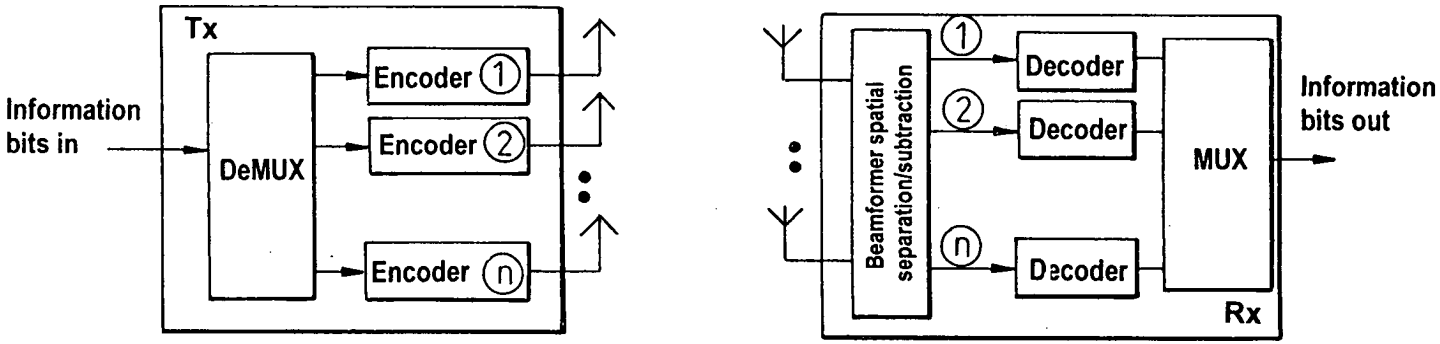
Fig. 18

Basic Space-Time Coding Techniques

Space-Time Block Coding (STBC)
- defined for 3G



Layered Space-Time (BLAST)
- more applicable to fixed/nomadic



Space-Time Trellis Coding (STTC)
- suitable for both mobile and fixed

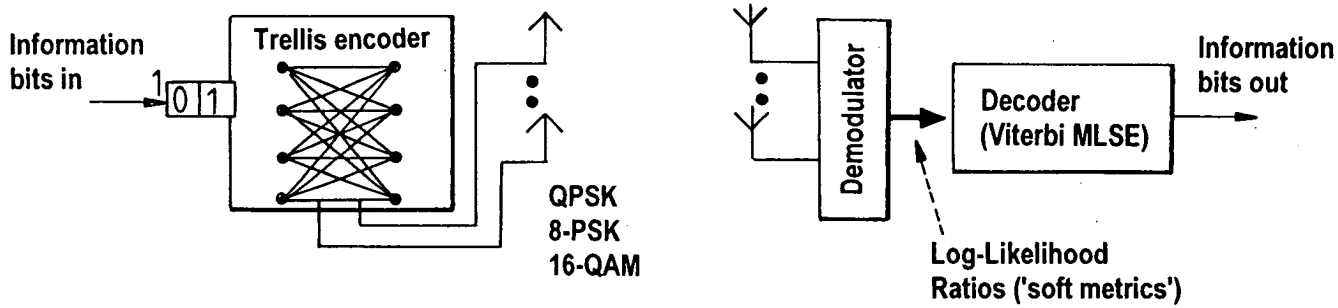


Fig 19

Feedback STC – Separated Subchannels

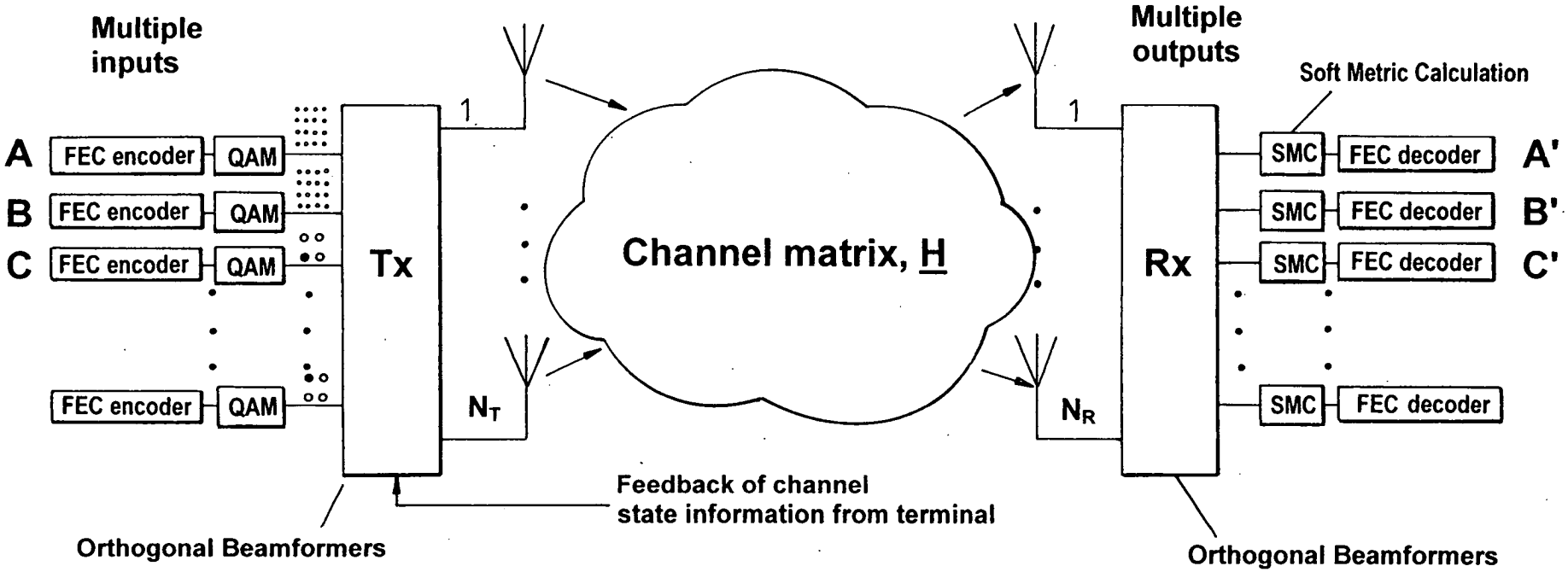


Fig. 20

Spatial Multiplexing STC

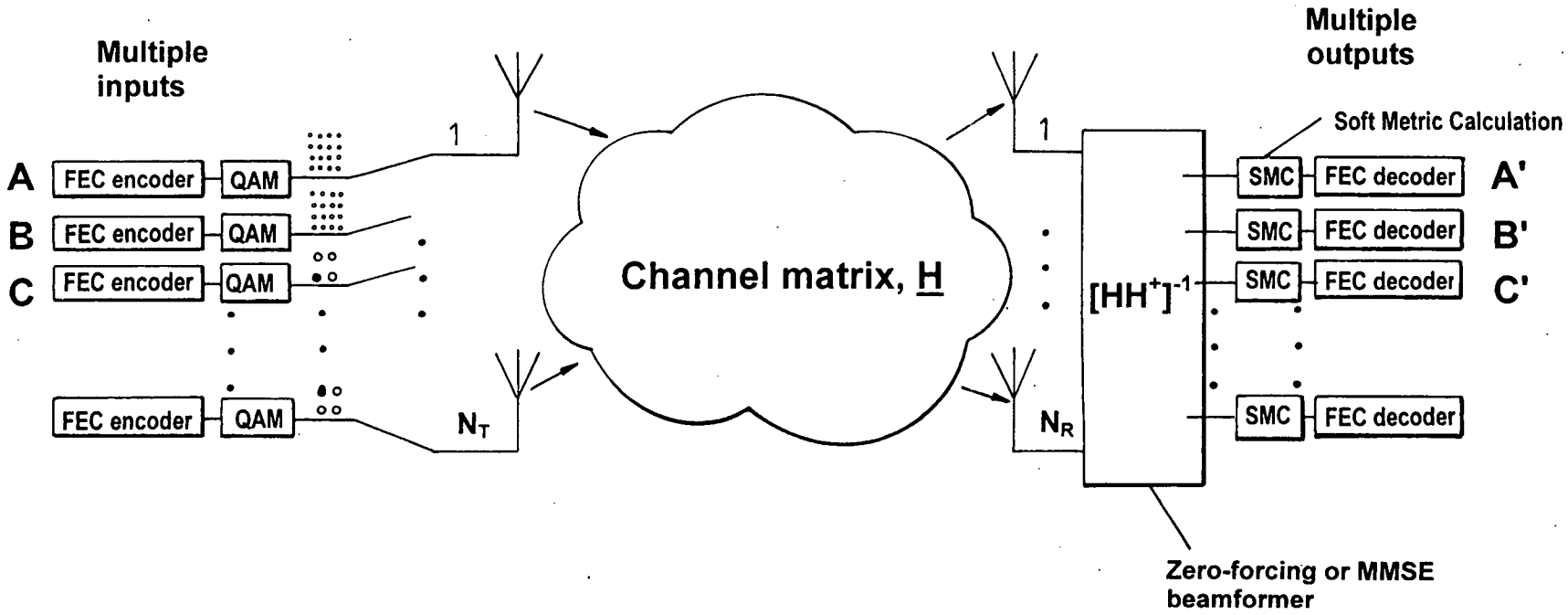


Fig. 21

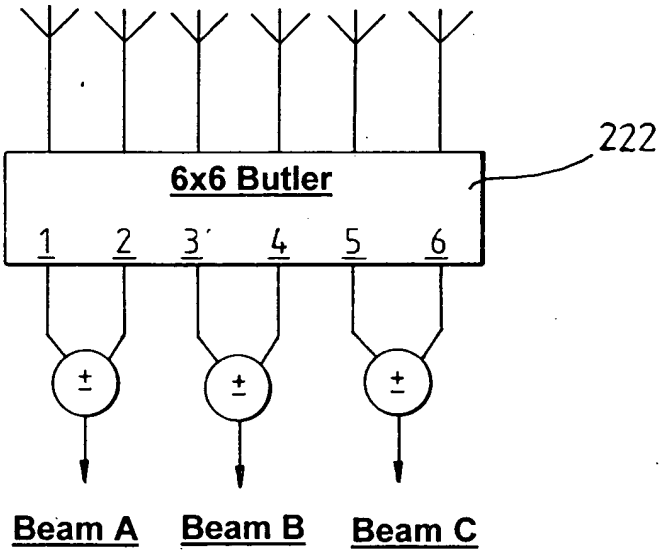


Fig. 22